Hawaii Agricultural Experiment Station,

HONOLULU.

J. G. SMITH, Special Agent in Charge.

UNIVERSITY OF FLORIDA LIBRARIES
NOV 1973
DOCUMENTS DEPT.

PRESS BULLETIN No. 11.

THE COMMON LIVER FLUKE IN HAWAII.

(Distoma hepaticum)

The fact that 990 cattle out of 3,376 slaughtered for the Honolulu market during a period of six months in 1902 showed an infection of the liver-fluke and that in certain districts this parasite has become epizootic among cattle, calls for a brief compilation concerning the disease, its cause, transmission and remedies. An earlier record places the number of fluky cattle killed for market still higher. "In some parts of Oahu nearly all the cattle have been destroyed by the disease; the sheep from dry districts, however, are not affected. Of 602 calves examined at Honolulu, 298 were found infested; of 2,186 cattle, 1,313 were infested, so that about four-sevenths of the animals were diseased."*

The disease is not confined to cattle, and because of its varying symptoms, duration and variety of hosts has received numerous common names, the most familiar of which are, perhaps, the "sheep-rot" and "liver-rot." The hosts of the adult of this species are man, cattle, sheep, swine, cats, rabbits, horses, goats, deer, and other vertebrates, and during one phase of its intermediate development, certain fresh-water snails (*Mollusca*). The disease caused by this parasite has been especially destructive to sheep with the injury to cattle and swine next in importance. From reports it would seem that in no other portion of the United States has its attack on cattle been as serious as in Hawaii.

What the common liver-fluke is:—The parasite is one of the flat-worms (*Trematoda*) known to science as *Distoma hepaticum*. In appearance it is perfectly flat, unsegmented and leaf-like

* Bulletin 19. Bureau of Animal Industry, U. S. Department of Agriculture. 1893, p. 42.

UNIV. OF FL LIB.
DOCUMENTS DEPT.
U.S. DEPOSITORY

SHOUT
SHARE
IT

and the specimens taken from infected cattle varied from ½ inch to 1 inch in length. (See Plate I. G and H.) It infests in cattle the liver, gall-bladder, bile-ducts, and has been found in the lungs.

The life history of the common liver-fluke:—(See Plate I.) The life-history of the fluke is a very complicated affair, occupying from 10 to 12 weeks. A brief statement of the important phases is sufficient for the purposes of this paper. The eggs (see Plate I. A and B) of an adult fluke, numbering from 37,000 to 45,000, pass from the liver of the infested stock, through the bile-ducts to the stomach and then to the intestine, from which they are expelled with the faecal matter and, to further develop, must fall or be washed into water. In water, and water only, there develops within the egg a ciliated embryo which finally bursts through the eggshell and swims actively about. To further develop this organism must find or come in contact with certain fresh-water snails. Two species of these intermediate hosts are recorded from these Islands, *Limnaea oahuensis* (see Plate I. I and J) and *Limnaea rubella*. The former species occurring on Oahu and Maui and the latter on Oahu and Kauai.*

It is probable that one or both species are generally distributed over the Islands, but if certain districts are free from these species the stockmen of those districts have certainly reason for self-congratulation, since because of their part in the transmission of the liver-fluke disease, their presence is equally as dangerous to the interests of the ranchers as the presence of the fluke itself. To continue with the life-history,—these swimming ciliated embryos (*miracidium*), (see Plate I, C.) minute in size, bore their way into the body of the snail, if fortunate enough to find a host, and seek lodgment in the liver or other parts of the body. Here another change in the life-cycle occurs. The organism becomes quiet and forms what is known as a *sporocyst*. (See Plate I, D.) In this inactive state each sporocyst gives rise to from 5 to 8 organisms within itself called *rediae*. These rediae may be considered a second generation of the immature liver-fluke which leave the sporocyst when fully developed and seek the liver of the snail, if not already lodged there. Within the liver of the snail there is still another multiplication of individuals, that is, each redia (see Plate I. E.) gives rise to from 12 to 20 further organisms known

---

* Fauna Hawaiiensis. Vol. II. Part IV, pp. 392, 393.

as *cercariae*. This further development makes still a third generation. The cercariae pass from the body of the snail into the water and attach themselves to blades of grass (see Plate I. F.) or such plants as may occur in or about any standing water; or, during a time of high water, they may be carried out on the range and, when the water recedes, left on the grass some distance away; or, again, they may be washed from the higher levels to fields below. On becoming attached to the blades of grass or the stems of other plants, the cercariae become encysted, or dormant again, and so remain for an indefinite period, until swallowed with the grass or other forage plant eaten by the stock. Local infection has been traced to the feeding to cattle of a much-prized forage plant known as hono-hono (*Commelina nudiflora*), which grows abundantly about water-courses throughout the Islands. In the stomach of cattle or other animals eating plants thus infested with the encysted cercariae, the cyst or covering is destroyed and the undeveloped liver-fluke, becoming active again, seeks the liver of the host through either the gall-ducts or portal veins, and develops into the adult fluke, already mentioned, thus completing the life-cycle.

The immense number of eggs and the large increase of each intermediate generation would mean an increase of the adult fluke almost beyond numbers, were it not for the small chance any one individual has of reaching maturity. In the first place, few indeed of the eggs in the faecal matter find their way to water in which they may hatch into the second stage. Again, not all of the resulting ciliated embryos in the water succeed in finding the particular fresh-water snails which are their special hosts. Failure to find the proper snail results in extermination. Finally, not all of the encysted undeveloped flukes on the blades of grass are eaten by stock. However, it can be plainly seen that where conditions are favorable, that is, where standing water abounds where the snails are present and about which fluke-infested stock are feeding, the liver-fluke disease can readily become epizootic.

Symptoms of the disease in cattle:—"The first symptoms are generally overlooked, the disease not attracting attention until the appetite is diminished, rumination (chewing the cud) becomes irregular, the animals become hidebound, and the coat dull and staring. The staring coat is due to the contraction of the muscles of the hair follicles. The visible mucous membranes be-

come pale, eyes become dull, there is running at the eyes, and the animal gradually becomes emaciated. As the disease advances the milk supply is lessened, fever appears, there is generally great thirst, but the appetite almost ceases; oedematous (dropsical) swellings appear on the belly, breast, etc.; diarrhoea at first alternates with constipation, but finally becomes continuous. The disease lasts from 2 to 5 months, when the most extreme cases succumb."* Animals observed in the last stages of the disease, on the windward side of Oahu, could be distinguished from the rest of the herd because of their standing alone, with head up and apparently without inclination to eat or move. Several post-mortems were made and notes taken in regard to the symptoms. The blood had become almost free from red corpuscles. Effusion of the blood serum had occurred into the abdominal and lung cavities. In every case enormous numbers of flukes were found in the liver, gall-bladder and bile-ducts. In the final stages the respiration becomes rapid and towards the last breathing becomes very difficult, due to the extension of the dropsical swellings, occurring along the under side of the body to the neck and throat so that the animal apparently dies from suffocation and starvation.

Determination of the presence of flukes:—The eggs may be discovered, if present, by a microscopical examination of the faecal matter, or a suspected animal slaughtered and its liver and bile-ducts examined for the flukes themselves. If the cattle are found to be fluky it would be better to slaughter them for the market at once since in the early stages of the disease they have a tendency to fatten, owing to the excessive secretion of the digestive ferments, and not only would there be a better return for the stock but also by destroying the infected organs and contents of the intestines, the spread of the disease would be checked.

Where flukes may be expected to be found:—In general the statement is correct that flukes may abound wherever the conditions are suitable for the life of its intermediate host, the fresh-water snail. This would mean any range or pasture containing a body of water or marshy place harboring this snail; and, the previous introduction of the fluke. Stockmen should be careful not to take fluky cattle from place to place and by no means

* Bulletin 19, Bureau of Animal Industry, U. S. Department of Agriculture.

purchase stock from a fluke-infested district. A law forbidding the sale of infested stock except for the market and providing for the inspection of ranges with the power of enforcing the disuse of areas and localities found to be fluke-infested until proper precautions were taken would do much towards lessening the spread of the disease and checking its serious inroads into the herds of these Islands.

Remedies:—Slaughtering and marketing fluky cattle before the last stages of the disease is undoubtedly the most practical method of stamping out infection. The liver is the only part of the carcass rendered unfit for food and great care should be taken to destroy this organ, the gall-bladder, bile-ducts and contents of the intestines. No drugs or mixtures have been found by which the disease can be successfully treated. However, in case a valuable animal is seriously affected an improved diet together with liberal use of stimulants and tonics will in many cases build up the system and general vitality so that the animal may live through the fourth stage of the disease, when the flukes will die or wander out from the infested organs spontaneously. This treatment would include the use of cocoanut meal, bran and mill feeds, with daily doses of the various iron salts, walnut leaves, calamus and gentian. These remedies would only be applicable to the treatment of milch cows and fine breeding stock.

Precautionary measures:—The following preventive measures for controling the liver-fluke disease are taken from Bulletin No. 19 of the Bureau of Animal Industry, United States Department of Agriculture:

To prevent the scattering of eggs in the fields:

In buying cattle or sheep, do not purchase any from a fluky herd, as they may introduce the disease to your farm.

If animals are fluked, send those which are most affected to the butcher and place the others on dry ground.

Destroy the livers of the slaughtered animals, or if used as food for animals (dogs, etc.,) they should first be cooked in order to kill the eggs; if this precaution is not taken, the fresh eggs will pass through the intestine of the dog uninjured and be scattered over the fields.

Manure from fluky animals should never be placed upon wet ground. It is, however, not dangerous to use such manure upon dry ground.

As rabbits and hares may introduce the disease into a district, or may keep up an infection if once introduced, these animals should be kept down as much as possible. This is not always practicable. (This precaution does not apply to Hawaii in so far as rabbits and hares are concerned but is most important as regards the wild goats and swine.)

Where animals very heavily infested with flukes have pastured on a given piece of ground, some one should go over the field with a spade and spread out the patches of manure, so that it will dry more rapidly, and thus the eggs may be more quickly destroyed. A spade full of lime or dust will aid in drying up the manure patches. (Applies only to dairy herds in Hawaii. It is a good point to mention in this connection that this practise will also be fatal to the eggs of the horn-fly, deposited in the fresh manure by the adult fly.)

Manure of fluky animals should not be stored where it can drain into pastures,

To control marshy ground:

The marshes should be drained, if possible, so that the snails may be gotten rid of.

It has been noticed that sheep which pasture on salt marshes are not fluked; accordingly dressings of salt, to which lime may be added, should be spread over the pasture, as salt and lime will destroy the embryos, the encysted cercariae, and the snails. . . .

Lime will destroy the grass for immediate use, but will in some cases be advantageous to the soil. . . .

If the marshy ground cannot be controlled, place the animals on higher ground. (This also does not generally apply to Hawaiian conditions, since in many places the constant moisture of the higher altitudes renders the conditions ideal for the life of the snail and the development of the parasite.)

To destroy the snail.—This may be done by draining the fields, thus depriving the snails of the conditions necessary for their development, or by the free use of salt and lime.

General precautions to be taken:

It is known that salt will kill the cercariae; accordingly if salt is given to the animals they stand a better chance of escaping hepatic (fluke) infection, even if the germs are swallowed, not only because this substance kills the young flukes, but because it aids the animals in their digestion. (The value of feeding salt to fluke-infested stock has been proved by experiments noted in this connection but which are not quoted.)

A daily allowance of dry food should be given.

If fields are overstocked the animals will be obliged to graze very close to the ground, and will thus be more liable to become infected, accordingly, in order to prevent this close grazing, fields should not be overstocked.

Animals should not be left too long upon the same pasture.

Raised watertanks should be placed in the pastures so that the herds will not be forced to drink from pools, etc. As it is difficult for snails to get into such drinking tanks, there will be little fear of infection from tanks of this sort.

JARED G. SMITH,
D. L. VAN DINE.

HONOLULU, T. H., *January* 5, 1905.

EXPLANATION OF PLATE I.

The Life-Cycle of the Liver-Fluke, *Distoma hepaticum*. A.—Egg of the common liver fluke containing a developed embryo. Magnified 130 diameters. B,—Egg after hatching. C,—The ciliated embryo as it appears before attacking the fresh-water snail. Magnified about 350 diameters. D,—A sporocyst which has developed from the embryo within the body of the snail, in which may be seen the developing rediae. Magnified 200 diameters. E.—Redia in the liver of the snail with developed cercariae. Magnified 150 diameters. F,—Encysted cercariae on a portion of a grass stalk. Magnified 10 diameters. G,—Young of liver fluke which has developed from cercariae in liver of stock. Natural size. H,—Adult liver fluke from liver of stock. Natural size. I and J,—The fresh-water snail, *Limnaea oahuensis*, an intermediate host of the liver fluke. Slightly enlarged. (A, B, C, G and H copied from Neuman's Parasites and Parasitic Diseases of Domesticated Animals. D, E, F, I and J copied from Bulletin 19, Bureau of Animal Industry, U. S. Department of Agriculture.)

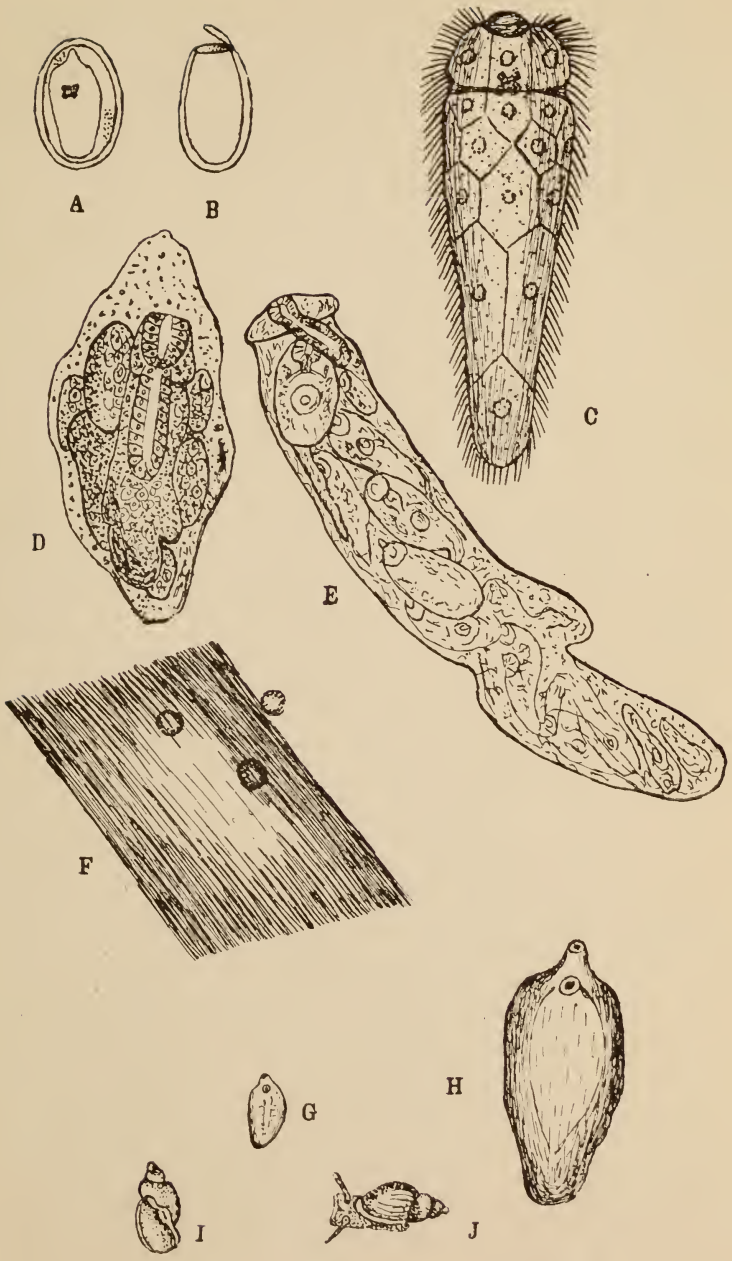

PLATE I.

UNIVERSITY OF FLORIDA
3 1262 08929 1131